

lutely perfect may, I found, be most imperfect on a man or woman. I once thought I had established a perfect local anæsthesia by applying to animals narcotic solutions locally, in combination with a gentle continuous electric current. It seemed to me that the current caused a rapid absorption of the narcotic, or so acted with it on the minute blood-vessels as to produce contraction of them and destroy local insensibility. Under this plan I performed a number of operations on the lower animals without exciting the slightest evidence of pain. When I came to man the process broke down; some insensibility was, without doubt, produced, and seventeen operations were performed by the local plan. But the more exalted sensibility of the higher animal was not satisfied, and I learned that what would do perfectly for a dog was quite inefficient for a human being.

It is a curious episode in this research and worthy of record, that one of my scientific critics, the late Dr. Waller, a man of great genius, actually showed that he could perform on dogs without any anæsthesia at all, the same operations that I performed with this local anæsthesia, and with similar apparent freedom from pain. The result was that I continued all my after experiments on local anæsthesia, first on my own body, and then on other human subjects who required such anæsthesia for operation. All my experiments with sprays to produce insensibility by intense cold, on Dr. James Arnott's most original design were first performed in this manner, and the process was only applied to the inferior animals after it had been made perfect for the surgical purposes for which they required it. In this instance therefore man became the subject of physiological experiment for the benefit of the inferior animals as well as for his own.

Primary Results of the Experimentation with Anæsthetics.

The primary results of these experiments on different modes and processes for inducing anæsthesia may be put forward in a few sentences. They were all of them results which could not have been reached by any other line of research.

1. The experimentation has enabled me, as a physician, to keep on a level with the chemist in applying to the services of man all those agents for the relief of pain which the chemist produces. The chemical bodies of the methyl, ethyl, butyl, and amyl series with several others which have promised to be of any service have been tested, and their respective values carefully chronicled.

2. For general anæsthesia I have been enabled, by the research to add many new and useful anæsthetics. Bichloride of methylene, which has been very largely used, and which Mr. Spencer Wells invariably uses with signal success for ovariectomy, came from this research. Methyl ether, the safest anæsthetic I have yet known, was proved by this research. Methylal, another very valuable agent of the same kind, and which has to be practically applied, is another good anæsthetic added by these inquiries; while several agents tried for anæsthesia which have not answered, have been accidentally discovered to possess other and valuable curative properties. The introduction of the ethereal solution of peroxide of hydrogen, an exceedingly useful remedy, and the local use of butylic alcohol for toothache, are two instances amongst many more of this kind.

3. The researches have enabled me to formulate the physiological properties of the organic bodies that produce anæsthesia, so that the value of the anæsthetic compounds may be calculated from their physical characters and composition. I have been able to show that some elements—such as chlorine—are objectionable parts of an anæsthetic agent, others favourable; that certain degrees of solubility are objectionable, others favourable; that certain vapour-densities are objectionable, others favourable. I have been able to point out a distinct theoretical standard of

qualities which, being found, will yield a safe, manageable, and agreeable anæsthesia. Lastly, I may add, from an experience in the study of anæsthetics extended from the time when they were first introduced until this hour, the positive assurance that careful and steadily pursued experimental research must result in the discovery of all the laws relating to anæsthesia, and to the further discovery of an absolutely safe mode of producing it. For I have learned that no man, no animal, ever yet has died because it was rendered insensible to pain, and the deaths which have occurred have invariably been due to some property of the substance used that had no relation to the anæsthetic property—some independent bad quality which we may fairly expect science to eliminate for the benefit of man.

4. While striving to apply the results of experimentation to the advantage of the human family, I have not forgotten the inferior creation, and in nothing have I been more successful than in their behalf. For operations on animals I have been able to make the application of local anæsthesia so perfect that there is no necessity whatever that any lower animal should ever feel a pang from the knife of the operator for any external cutting operation it may have to undergo. The Society for the Prevention of Cruelty to Animals has itself published the facts of an operation, for removal of a large tumour from a horse belonging to Sir Wm. Erle, that was performed by my method of operating under ether spray while the animal stood in the stable without halter or bridle, oblivious of all pain. That fact,—one of a hundred similar,—I put forward, not as in itself peculiar, but because of the record from which it is taken. It could not have been recorded even there but for the experimentation that gave it birth.

BENJAMIN W. RICHARDSON

NOTES

HER MAJESTY has been pleased to confer on Prof. Wyville Thomson the honour of knighthood.

IT is stated that Sir C. Wyville Thomson and the members of the scientific staff of the *Challenger* will be entertained at dinner in Edinburgh on July 7. The Lord Provost has consented to take the chair.

WE notice from the official announcement in connection with the Loan Collection, that during the present week, fourteen demonstrations of apparatus were given on Monday, eleven on Tuesday, four on Wednesday and Thursday, while seven will be given on Saturday. With regard to the complaint in the *Times* as to the occasional non-attendance of the lecturers, it should be remembered that these demonstrations are given out of pure good-will by some of the most eminent and busy of the scientific men of the day, who are not always masters of their own time. The Department's arrangements are entirely dependent on the convenience of these men, and it should not therefore be blamed if its proposed programmes are not always rigidly carried out. The following arrangements have been made for future free evening Lectures on the Instruments in the Collection:—Saturday, July 1, Prof. Tyndall, F.R.S., on "Faraday's Apparatus," in the Lecture Theatre, South Kensington Museum; Monday, July 3, the Right Hon. Lyon Playfair, C.B., M.P., F.R.S., on "Air and Airs," as illustrated by the Magdeburg Hemispheres and Black's and Cavendish's Balances; Saturday, July 8, Dr. Gladstone, F.R.S., "The Work of Davy and Faraday," as illustrated by the Apparatus lent by the Royal Institution; Monday, July 10, Rev. R. Main, M.A., F.R.S., on "The Instrumental Foundations of Practical Astronomy;" Saturday, July 15, Dr. W. H. Stone on "Modes of Eliciting and Reinforcing Sound;" Monday, July 17, Mr. C. V. Walker, F.R.S., on "Galvanic Time Signals;" Saturday, July 22, Mr. W. Chandler Roberts, F.R.S.,

on "Graham's Apparatus;" Monday, July 24, Mr. J. N. Douglass, "The Lighthouses on the Great and Little Basses Rocks, Ceylon."

WE would draw the attention of our readers to a leader in yesterday's *Daily News*, in which a proposal is referred to for obtaining a charter to incorporate Owens College, Manchester, into an University. The subject is one of the greatest importance, and now that France is following the lead of Germany in the matter of University reform, we are glad to see some signs that this country is also beginning to feel the necessity of extension and reformation in this direction.

WE read in the *Scotsman* of June 26 that "the prediction of Capt. Saxby that a great storm might be expected last week had a very prejudicial effect on the fishing of Anstruther, and the fishermen suffered a loss of at least 500*l.* from their too ready acceptance of the prophecy." The point to be wondered at is, not that the fishermen of Anstruther, where a terrible loss of life took place in November last, accepted the prediction and acted upon it, but that such a prediction, when made, should be gravely and generally circulated broadcast over the country by the newspaper press, even though, in the present state of our knowledge, two, or at the very utmost three days' forecast of a storm is all that can be attempted, any more distant prediction being the merest guess-work.

AT Monday's meeting of the Royal Geographical Society, a letter from General Stone (Cairo), on "The Circumnavigation of the Lake Albert Nyanza," by M. Gessi, was read. The points of importance in M. Gessi's paper were that the Lake Albert Nyanza is one hundred and forty miles long and fifty broad, and that in the east there is a river flowing into the lake which is now confidently believed to be one of the sources of the Nile. This, Sir R. Alcock said, was a most important result of M. Gessi's expedition, as it made it quite clear that the White Nile issued from the Lake Albert Nyanza. Sir Samuel Baker had written to him (Sir R. Alcock) endorsing the importance of M. Gessi's discoveries, which had established a fact that for eighteen centuries had baffled all the geographers of the world. The secretary read a letter which had been forwarded to the Society by the Earl of Derby, giving a summary of information which had reached her Majesty's government in regard to the movements of Col. Gordon, who expects that within a very short time the interior of Africa will be sufficiently secure to allow both merchants and travellers to traverse the country in perfect safety. A paper was read by Capt. Hay describing the district of Akem in West Africa. He had found the country rich in minerals and studded with well-built towns. The men had a peculiar formation of the cheek-bones which closely resembled horns, the chief executioner having this peculiarity so largely developed as seriously to interfere with the performance of his official duties. The women of the country were free from this deformity.

DURING last week a young living male gorilla was seen at Liverpool for a few days on its way to Hull, and thence to Germany. It had been brought from the West Coast of Africa by the German African Society's Expedition, and measured three feet in height. This is the second specimen of a gorilla which has, with certainty, been seen living in this country. The first during its lifetime, twenty years ago, was mistaken for a chimpanzee.

THE Dublin Corporation have resolved to co-operate with the Royal Dublin Society to invite the British Association to that city in 1878.

THE Italian naturalist Signor Odoardo Beccari has arrived at Genoa, from his fourth journey into New Guinea, and brings with him a valuable collection of objects illustrating the natural history of the country.

LAST week a deputation from Scotland waited upon the Prime Minister to urge that grants should be made out of the Imperial Exchequer to extend and improve the buildings of the University of Edinburgh. They presented a memorial showing that this was very much wanted; that Scotland had already subscribed 81,000*l.* out of a total of 261,000*l.* required; that the University conferred benefits upon the whole country, and on that ground they asked for Imperial funds. Mr. Disraeli said that the subject should occupy the thorough attention of her Majesty's government, with, he was sure, a desire on their part to meet any reasonable expectations.

THE REV. A. H. SAYCE has been appointed Deputy-Professor of Comparative Philology in the University of Oxford. Mr. Max Müller still holds the professorship although absent from Oxford.

LIEUT. WEYPRECHT and Count Wilczek have proposed to the Geographical Society of Paris to co-operate in the establishment of meteorological stations under the polar circle. Nine stations are to be located at Point Barrow, Upernivik, mouth of Lena, Novaya Zemlya lat. 76°, Spitzbergen lat. 80°, Eastern Greenland, and Finmark. The French Geographical Society is willing to lend its assistance, but very likely will insist upon postponing the establishment of these observatories till 1878, when it is expected news from the English Arctic Expedition will have been received, and advantage may be taken of any facts thus elicited.

PROBABLY few of our readers are aware that at the rooms of the Horticultural Society, at South Kensington, exists a valuable botanical and horticultural library, free alike to Fellows and non-Fellows of the Society. This is known as the Lindley Library, having belonged to the late Dr. Lindley, and since it was purchased by the Society it has received valuable additions. From want of sufficient funds and proper accommodation it is not, however, so useful as it might be; and the Society will be glad to receive additions of books, pamphlets, periodicals, &c. Such gifts, we are sure, would be well bestowed. Communications should be addressed to Mr. W. B. Hemsley, librarian and secretary to the trustees.

THE French geographical journal, *L'Explorateur*, for June 22, has an article on the last cruise of the *Challenger*, in which several of the illustrations in our *Challenger* number for June 1, are reproduced, including a very good woodcut copy of the steel portrait of Sir C. Wyville Thomson.

M. LEVERRIER has appointed a Commission to report on the working of the great reflector, and to suggest improvements. The investigations have been first directed on the mechanical work, which is admirable, and a reward is to be proposed to be given to M. Eichens, the maker. But the optical part is said to admit of improvements in respect to the mirror, which does not appear quite so good as was supposed at first. No pains will be spared to approach perfection as far as possible, as the observatory is to be considered as an annexe of the International Exhibition, and foreign astronomers will be admitted to use the great reflector under certain regulations.

A PHILOLOGICAL novelty in American literature is furnished by the appearance in German of the annual report of the Natural History Society of Wisconsin (*Jahresbericht des naturhistorischen Vereins von Wisconsin*) for 1876, this being, so far as known to us, the only scientific serial published in that language in America. Canada has one or two French scientific journals, and Mexico several, of course published in Spanish.

IN the *Repertorium für Meteorologie*, vol. v., No. 4, St. Petersburg, Baron F. Wrangell has written a very suggestive paper on the causes of the bora at Noworossisk, a local wind characterised by peculiar violence and destructiveness to shipping in that part of the north Caucasus coast. The author

rests his explanation exclusively on the physical peculiarities of the district and recognised physical laws. To the north-east of the bay, where the bora is most severely felt, and at a distance of about two miles, lies the mountain range of the Waradáh, about eleven miles in length, which, as regards winds, cuts off all communication between the coast and the interior, except over the ridge of the chain; and, further, has several valleys on the landward side of the range looking to north-east. It follows that on particular occasions, notably when the wind is in the north-east and light, the air resting on the bay and shore adjoining will be widely different in temperature, humidity, and consequently density, from the air on the other side of the range. Observations render it highly probable that it is just on such occasions that the bora occurs. Baron Wrangell's hypothesis regarding the bora is that it is occasioned by the overflow, by way of the ridge, of the dry, cold, and dense air of the interior down upon the moist, warm, and light air which fills the basin of the bay—a supposition in accordance with all the known phenomena accompanying the bora, including the hour of the day and the general weather conditions under which it occurs. In the neighbouring bay of Gelendschik, on the other hand, which has a deep valley opening directly into it from the north, and therefore does not afford such facilities as Noworossisk does of bringing together, with only a ridge between them, two widely different masses of air, the bora is much less sudden and violent. From the practical and scientific importance of the inquiry, we hope Baron Wrangell's suggestion will be carried out, and several stations be established in addition to the present stations, at different heights on both sides of the Waradáh chain, for observations of pressure, temperature, humidity, and winds, so that the causes from which the bora and other violent local winds take their origin and attain their greatest intensity, may be determined.

THE Rev. R. Main, of the Radcliffe Observatory, has published a short paper on the rainfall at Oxford for the past twenty-five years, with tables of the monthly and annual amounts, the summer rainfall of each year, all the days on which an inch of rain or upwards fell, and the daily amounts during October and November, 1875. In every way in which the figures can be looked at, October is the month of greatest, and February that of least, rainfall, as holds generally over nearly all the south of England. June, which in the north-west of Great Britain is the month of least rainfall, has at Oxford a rainfall exceeded only by that of October, a result doubtless due to the much greater prevalence of thunderstorms at this season at Oxford, and of those weather conditions out of which thunderstorms originate. Another noteworthy feature of the Oxford rainfall is the small amount in December as compared with January. The average annual amount is 25·775 inches, the least 17·564 inches in 1870, the greatest 40·416 inches in 1852; the greatest monthly fall 7·531 inches in October 1875; the largest daily fall 2·050 inches on July 25, 1861; and 1·180 inch appears to have fallen in two hours on July 20, 1859.

A RUSSIAN scientific congress, *Iron* states, is to meet at Warsaw next September, at which the question of adopting the Gregorian calendar in Russia will be discussed.

THE Municipal Council of Paris has resolved to support a resolution of the Société Française de Navigation Aérienne, which has petitioned the French Government to be recognised as an Establishment of Public Utility. This step is necessary according to the French laws, to give to the Society a legal existence and enable it to hold property and receive legacies.

THE *Quarterly Bulletin of the Nuttall Ornithological Club* is the title of a new ornithological periodical published at Cambridge, Massachusetts. It forms twenty-eight pages and contains a plate. The size of the future parts will depend to a great extent upon

the number of subscribers, and a plate cannot be promised in future unless the means assure it. Vol. i. No. 1, contains a description and figure of a new species of *Helminthophaga*, by Mr. Wm. Brewster; the account of a specimen of the Common Buzzard in North America, by Mr. Maynard; note on the nestling of the Golden-winged Warbler in Massachusetts, by Mr. J. Warren; notes on the Rough-winged Swallow in Pennsylvania, by Mr. W. van Fleet; and on the breeding of the Black-throated Blue Warbler in Connecticut, by Mr. C. M. Jones. Mr. Henshaw writes on *Empidonax traillii* and *E. acadicus*, Mr. R. Deane on Albinism and Melanism among North American birds, and Mr. H. B. Bailey ends the volume with notes of birds found breeding on Cobb's Island, Virginia.

To judge from the Second Annual Report of the Hastings University School Naturalists' Field Club (1875-6), that Society is in a healthy condition. It consists of forty-eight members, and its object is to study and collect specimens to illustrate the Natural History of Hastings, and to compile a list of its flora and fauna, and to form a museum representing its zoology, geology, and botany. The Society is divided into five sections, and seems to be animated with a laudable enthusiasm for its objects, which we hope will be maintained. A large proportion of papers read at the meetings of last session were by members.

THE principal papers in part iii. of vol. xiv. of the *Transactions of the Manchester Geological Society* is on "Fires in Coal Mines," by Mr. J. Thompson, F.G.S.

WE are only able to note the receipt of the Sixth Annual Report of the Wellington College Natural Science Society. The work done by the Society, the Preface states, has been up to the average of former years, though evidently not what it might be with increased energy. We hope, with the Preface, that now that science has become an integral part of school work, a corresponding increase of interest will be manifested by the pupils in the Natural Science Society.

FROM the Annual Report of the Belfast Naturalists' Field Club (1874-5), we learn with pleasure that that Society is materially in a prosperous condition. It was this Society, our readers may remember, who got up the admirable "Guide to Belfast and Adjoining Counties," in view of the meeting of the British Association in Belfast. There are a number of good papers in the present Report, of which we may mention the following:—"On the Origin of Eskers," by Mr. Harbison, and "Notes on the Rudely-worked Flints of Antrim and Down," by Mr. William Gray.

MESSRS. SAMPSON LOW & Co. have published in a separate form from the large work on South Australia, edited by Mr. Marcus, and recently noticed by us, Mr. J. Boothby's "Statistical Sketch of South Australia."

THE additions to the Royal Aquarium, Westminster, during the past week, include the following:—Smooth Serranus (*Serranus cabrilla*), Small-mouthed Wrass (*Acantholabrus exoletus*), Jago's Goldsinny (*Ctenolabrus rupestris*), Lesser Weever (*Trachinus vipera*), Gemmeous Dragonet (*Callionymus lyra*), Cornish Suckers (*Lepidogaster cornubiensis*), Chub (*Cyprinus cephalus*), Barbel (*Barbus fluviatilis*), Whitebait (*Clupea alba*, Yar.), Octopus (*Octopus vulgaris*), thirty specimens.

THE additions to the Zoological Society's Gardens during the past week include a Malbrouck Monkey (*Cercopithecus cynosurus*) from East Africa, presented by Dr. Stirling; two Tigers (*Felis tigris*) from Amoy, China, presented by Dr. Marchant Jones; five Red-headed Weaver Birds (*Pondia madagascariensis*) from the Isle of France; a Pine Martin (*Martes abietum*), European; a Sclater's Muntjac (*Cervulus sclateri*) and two Darwin's Pucras Pheasants (*Pucrasia darwini*) from China, deposited; an Eland (*Oreasia canna*), born in the gardens; a Central American Agouti (*Dasyprocta punctata*) from South America.